

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
11 July 2002 (11.07.2002)

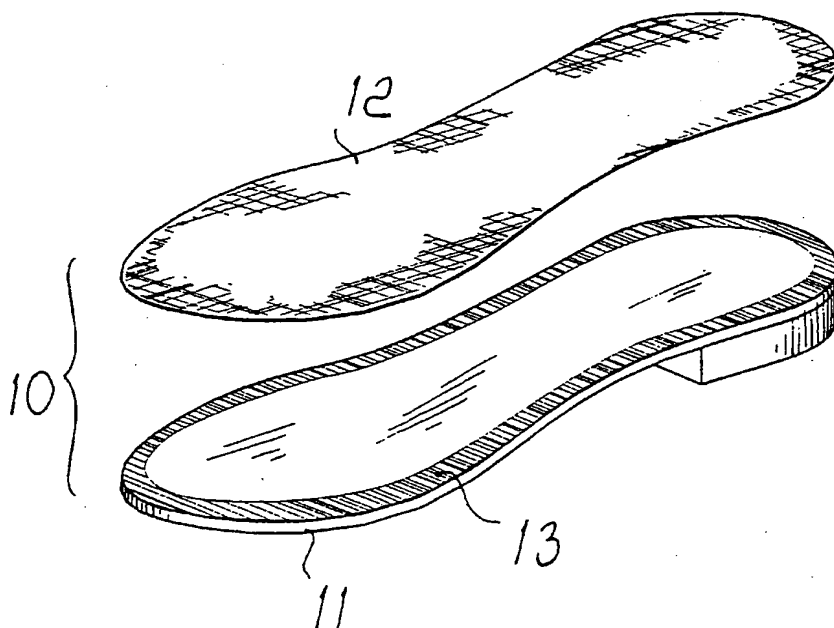
PCT

(10) International Publication Number  
WO 02/052970 A1

- (51) International Patent Classification<sup>7</sup>: A43B 7/12, 13/02, 13/12 (74) Agent: MODIANO, Guido; Modiano & Associati, Via Meravigli, 16, I-20123 Milan (IT).
- (21) International Application Number: PCT/EP01/15327 (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.
- (22) International Filing Date: 27 December 2001 (27.12.2001) (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: PD2001A000001 5 January 2001 (05.01.2001) IT
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- Published:  
— with international search report

[Continued on next page]

(54) Title: WATERPROOFED BREATHABLE SOLE FOR SHOES AND METHOD FOR THE MANUFACTURE THEREOF



(57) Abstract: A waterproofed and breathable sole (10) for shoes, which comprises a tread (11) made of leather, or similar breathable and water-permeable material, which is at least partially covered in an upward region by a membrane (12) made of a material that is breathable and impermeable to water and is perimetrically joined to the tread (11) with the interposition of a sealant (13) or by direct adhesion thereof so as to provide a seal.

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— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

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# WATERPROOFED BREATHABLE SOLE FOR SHOES AND METHOD FOR THE MANUFACTURE THEREOF

## Technical Field

The present invention relates to a waterproofed breathable sole for shoes  
5 and to the method for the manufacture thereof.

## Background Art

It is known that the main problem encountered in using shoes with an ordinary sole made of natural material, such as leather or equivalents, is constituted by wet conditions.

10 When rain and bad weather cause roads to become wet and slippery, it is not advisable to use shoes with leather soles, since leather, indeed because of its characteristic of being breathable and healthy for the foot, is not impermeable but on the contrary absorbs water.

The thinner the leather, the faster it becomes impregnated with water or  
15 moisture until the user's foot becomes wet.

This drawback is aggravated by the fact that the leather tread is not engraved and is smooth or even often polished with polishes.

This constitutes an additional problem with wet weather, since in these conditions grip is unsteady.

20 Accordingly, the use of shoes with a leather tread is constrained by weather conditions and therefore shoes with this type of material are mainly provided by manufacturers in summer collections in countries where the dry season lasts longer.

In order to obviate this drawback, the sole according to EP-0 619 959 has  
25 been devised: such sole comprises a tread made of leather or similar material, covered in an upward region by a membrane made of a material that is breathable and waterproof (fixed by spot gluing) and is assembled together with an upper part made of rubber or equivalent material (so as to provide a seal at the edge of the membrane) and has, at least in the regions  
30 affected by such membrane, one or more through holes.

Although it constitutes a considerable technological step forward that has allowed its unquestionable commercial success, in turn, the above described sole has been found to have drawbacks, such as high manufacturing costs owing to the need for templates and/or molds for cutting the membranes and  
5 for forming the perimetric seal.

Furthermore, the thicknesses produced by the presence of the upper layer with the tread increase the rigidity of the sole, and therefore some types of shoes that require high flexibility, such as women's shoes, encounter manufacturing difficulties.

10 Furthermore, the manufacturing system is scarcely flexible owing to the many operations required to achieve the finished product.

Another problem is the possibility that the membrane may delaminate from the sole, triggering abrasion phenomena with consequent loss of waterproofing.

15 Disclosure of the Invention

The aim of the present invention is to provide a sole and a method for the manufacture thereof that solve the drawbacks noted above in known types of waterproofed and breathable shoes with leather tread.

A consequent primary object is to provide a sole that can be thin and  
20 flexible.

Another object is to increase breathability.

Another important object is to provide a sole in which the danger of abrasion of the membrane is eliminated.

Another object is to increase user comfort.

25 Another object is to provide a sole that can be manufactured at low cost and therefore can be sold at a competitive price.

Another object is to provide a sole that can be manufactured with known equipment and techniques.

This aim and these and other objects that will become better apparent  
30 hereinafter are achieved by a waterproofed and breathable sole for shoes,

characterized in that it comprises a tread made of leather, or similar breathable and water-permeable material, which is at least partially covered in an upward region by a membrane made of a material that is breathable and impermeable to water and is perimetrically joined to the tread with the interposition of a sealant or by direct adhesion thereof so as to provide a seal.

#### Brief description of the drawings

Further characteristics and advantages of the sole according to the invention will become better apparent from the detailed description of some embodiments thereof, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is an exploded perspective view of the components of a first embodiment of the sole according to the invention;

Figure 2 is a perspective view of the sole of Figure 1, shown assembled and with the internal part of the membrane raised so as to graphically point out the peripheral sealing regions;

Figure 3 is a perspective view of the assembled sole in a second embodiment;

Figure 4 is an exploded perspective view of the components of the second embodiment of the sole according to the invention;

Figure 5 is a sectional view of the sole of Figure 3.

#### Ways to carrying out the Invention

With reference to Figures 1 and 2, a first embodiment of the waterproofed breathable sole for shoes is generally designated by the reference numeral 10 and comprises a tread 11, made of leather or similar breathable and water-permeable material (such as leather, open-cell synthetic material, et cetera), which is covered in the upper part, substantially in the plantar region, by a membrane 12, which is impermeable to water and vapor-permeable (breathable) and is preferably made of expanded polytetrafluoroethylene (PTFE) or of a hydrophilic polymer, such as polyurethane.

In particular, hydrophilic polymers are breathable owing to the presence, on their molecular chains, of functional groups capable of capturing the water molecule and of conveying it along their structure.

The membrane 12, which in this case preferably is devoid of any support,  
5 is provided with thicknesses that can vary between 5 and 40 microns.

The membrane is conveniently perimetrically spaced from the edge of the tread 11 (although it can be shaped complementarily to the edge of the tread 11) and forms a monolithic body with it by being joined thereto by means of suitable sealants, such as adhesives 13, which are for example spread  
10 perimetrically thereon.

Suitable adhesives can be constituted by hydrophilic polyurethane prepolymers in the semiliquid state or in solutions of organic solvents for a dry content of approximately 50% by weight.

It is possible to use, for example, a product of the Belgian company UCB  
15 S.A. known under the trade-name UCECOAT TD 9627/E.

The adhesives may also be conventional polyurethane adhesives or adhesives that are compatible with adhesion both with the membrane 12 and with the tread 11.

In practice, the adhesive 13 is spread on the upper part of the tread 11  
20 (with the appropriate addition of catalysts, if necessary, such as isocyanates or amine compounds) at least at the region of the edge of the membrane 12.

The hydrophilic polyurethane prepolymer is breathable, and therefore it might be spread over the entire region of the membrane 12.

Otherwise, when non breathable adhesive are used it is necessary to  
25 perform continuous perimetric spreading and internal spot spreading or deposition (on the membrane 12). Obviously breathable adhesives may also be used for spot deposition. A continuous internal spreading may instead be carried out if powdered adhesives (with a polyurethane base or of the heat-reactive type), which do not inhibit breathability, are used in the internal  
30 regions.

The membrane 12 is applied while the adhesive 13 is still moist.

The prepolymer polymerization reaction is facilitated by the high temperatures (approximately 150° for 30 seconds), which can be lowered by adding reaction promoters.

5 In 24 hours, the polymerization reaction can be considered complete and the sole 10 becomes a finished product.

It can be advisable to perform compression of the membrane 12 onto the tread 11 in order to improve coupling.

The addition of the catalyst and of the promoter also serves to improve  
10 resistance to hydrolysis and aging.

Wet application is designed to allow to wet the membrane 12 as well, so as to obtain optimum hermetic gluing.

It is also possible to provide cold gluing, by using adhesives that do not require catalysis, and final compression.

15 The membrane 12 constitutes a barrier to water and moisture but preserves the breathability characteristics given to the sole by the presence of the leather tread 11.

With reference now to the Figures 3 to 5, a second embodiment of the waterproofed and breathable sole for shoes is generally designated by the  
20 reference numeral 110 and comprises a tread 111 made of leather or similar material which is covered in the upper part, substantially in the plantar region, by a membrane 112, which is impermeable to water and permeable to vapor (breathable) and is preferably produced directly on the tread 111 itself by spreading a hydrophilic polymer, such polyurethane.

25 As mentioned, hydrophilic polymers are vapor-permeable due to the presence, on the molecular chains, of functional groups capable of capturing the water molecule and of conveying it along their structure.

The membrane 112, which is devoid of any support, is provided with thicknesses that can vary between 5 and 40 microns, preferably 20 microns.

30 The membrane 112 becomes monolithic with the tread 111.

Hydrophilic polyurethanes in the semiliquid state or in solutions of organic solvents, for a dry content of approximately 50% by weight, can be suitable in order to provide the membrane 112.

It is possible to use, for example, the product of the Belgian company  
5 UCB S.A. known under the trade-name UCECOAT TD 9627/E.

In practice, the prepolymer is spread onto the upper part of the tread 111, for example by means of a brush, a doctor blade, a roller, or by spraying (appropriately with the addition of catalysts such as isocyanates or amine compounds).

10 The polymerization reaction of the prepolymer is facilitated by the high temperatures (approximately 150° for 30 seconds), which can be reduced by adding reaction promoters.

In 24 hours, the polymerization reaction can be considered complete and the sole 110 becomes a finished product.

15 The layer of polymer that has been formed constitutes the membrane 112, which is self-sealed onto the tread 111.

The addition of the catalyst and of the promoter also serves to improve resistance to hydrolysis and aging.

In practice it has been found that the intended aim and objects of the  
20 present invention have been achieved.

The sole in fact has the qualitative characteristics of leather soles, particularly breathability, with the qualitative characteristics of soles made of rubber or synthetic material, particularly waterproofness, and with reduced thicknesses owing to the absence of the perimetric plastic element  
25 that is required in current ones in order to provide a perimetric seal.

It should be noted that sole according to the invention can be produced without particular difficulties with a manufacturing process that is operatively more flexible than the current one owing to the lack of templates and/or die-cutters.

30 Breathability is increased, especially in extremely humid conditions, with



respect to what can be obtained with current waterproofed leather soles, by increasing the surface available for breathing (the perimetric seal has been removed, and in some cases spot gluing is also eliminated).

Furthermore, any danger of abrasion of the membrane has been  
5 eliminated.

The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

All the details may further be replaced with other technically equivalent elements.

10 In practice, the materials used, so long as they are compatible with the contingent use, as well as the dimensions, may be any according to requirements.

The disclosures in Italian Patent Application No. PD2001A000001 from which this application claims priority are incorporated herein by reference.

CLAIMS

1. A waterproofed and breathable sole for shoes, characterized in that it comprises a tread (11,111) made of leather, or similar breathable and water-permeable material, which is at least partially covered in an upward region  
5 by a membrane (12,112) made of a material that is breathable and impermeable to water and is joined at least perimetrically to the tread with the interposition of a sealant or by direct adhesion thereof so as to provide a seal.

2. The sole according to claim 1, characterized in that said waterproof  
10 breathable membrane (12,112) is made of expanded polytetrafluoroethylene.

3. The sole according to claim 1, characterized in that said waterproof breathable membrane (12,112) is made of a hydrophilic polymer, such as polyurethane.

4. The sole according to claim 1, characterized in that said waterproof  
15 breathable membrane (112) is devoid of any support and is provided with thicknesses between 5 and 40 microns.

5. The sole according to claim 1, characterized in that said membrane (12,112) is spaced perimetrically from the edge of said tread.

6. The sole according to claim 1, characterized in that said membrane  
20 (12,112) is shaped perimetrically complementarily to the edge of said tread (11,111).

7. The sole according to claim 1, characterized in that said membrane (12) is monolithic with said tread (11) and is joined thereto through said sealant (13) constituted by adhesive spread on the tread (11) perimetrically.

25 8. The sole according to claim 7, characterized in that said adhesive (13) is at least one hydrophilic polyurethane prepolymer in the semiliquid state or in solutions in organic solvents for a dry content of approximately 50% by weight.

9. The sole according to claim 7, characterized in that said adhesive (13)  
30 is a conventional polyurethane adhesive, in any case an adhesive that is

adhesion-compatible with both said membrane and said tread.

10. The sole according to claim 8 or 9, characterized in that catalysts such as isocyanates or amine compounds are added to said adhesive (13).

11. The sole according to one or more of the preceding claims,  
5 characterized in that inside the sealed region said membrane (12) is spot-glued to said tread (11) by way of adhesives (13) that inhibit breathability.

12. The sole according to one or more of claims 1 to 10, characterized in that inside the sealed region said membrane (12) is glued to said tread (11) in a covering manner with adhesives that do not inhibit breathability, such as  
10 hydrophilic polymers.

13. A method for producing a sole according to one or more of the preceding claims, consisting in:

- spreading sealant on the upper part of the tread, at least at the position of the edge of the membrane,
- 15 -- applying the membrane while the sealant is still moist,
- performing catalysis either at high temperature, or at a lower temperature with addition of reaction promoters,
- performing cooling.

14. The method according to claim 13, characterized in that it comprises  
20 a compression step for compressing said membrane on said tread.

15. The method according to claim 13, characterized in that in the case that the sealant is a hydrophilic polyurethane prepolymer, spreading is performed on the entire region of the membrane.

16. The method for producing a sole according to one or more of claims 1  
25 to 12, consisting in:

- spreading sealant of the cold-acting type on the upper part of the tread, at least at the region of the edge of the membrane,
- applying the membrane while the adhesive is still moist.

17. The method according to claim 16, characterized in that it comprises  
30 a step for spot deposition, on said membrane, of adhesive that inhibits

breathability in the regions located within said edge sealant region before its application to said tread.

18. The method according to claim 16, characterized in that it comprises a step for the coating deposition, on said tread, of adhesive that does not  
5 inhibit breathability in the regions inside said sealant before said membrane is applied.

19. The method according to claim 16, characterized in that it comprises a step for compressing said membrane on said tread.

20. The sole according to claim 1, characterized in that said membrane is  
10 constituted by a hydrophilic polymer, such as polyurethane, and is provided directly on said tread and self-sealed thereon.

21. The sole according to claim 20, characterized in that said hydrophilic polymer is a polyurethane prepolymer in the semiliquid state or in solutions in organic solvents for a dry content of approximately 50% by weight.

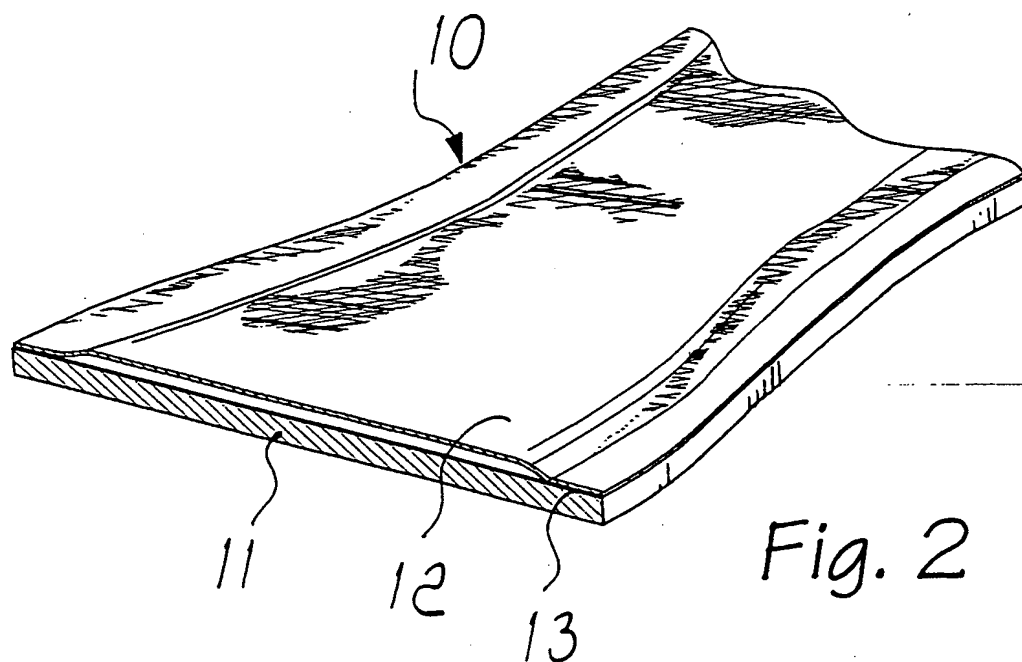
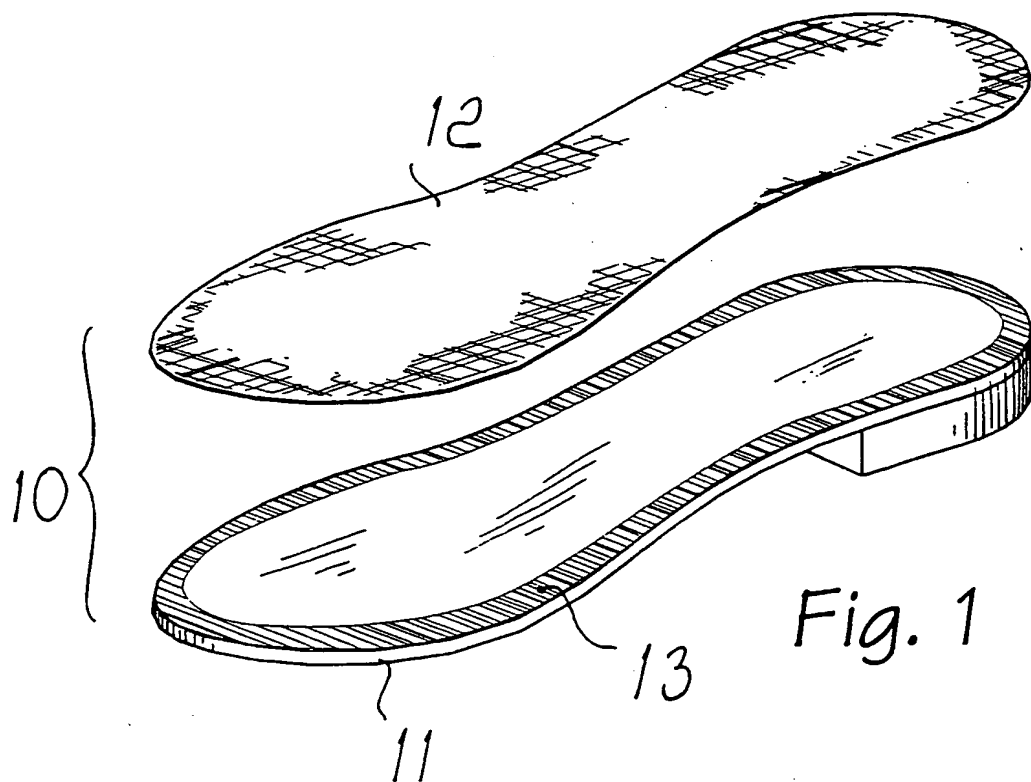
15 22. The sole according to claim 20 or 21, characterized in that said hydrophilic polymer receives the addition of catalysts such as isocyanates or amine compounds.

23. A method for producing a sole according to one or more of claims 1, 20, 21 and 22, consisting in:

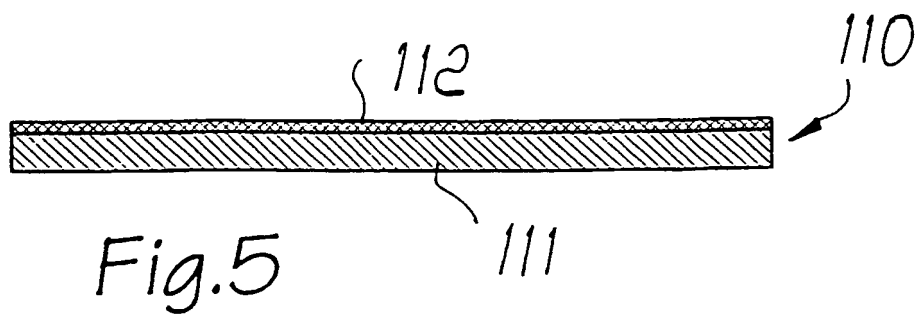
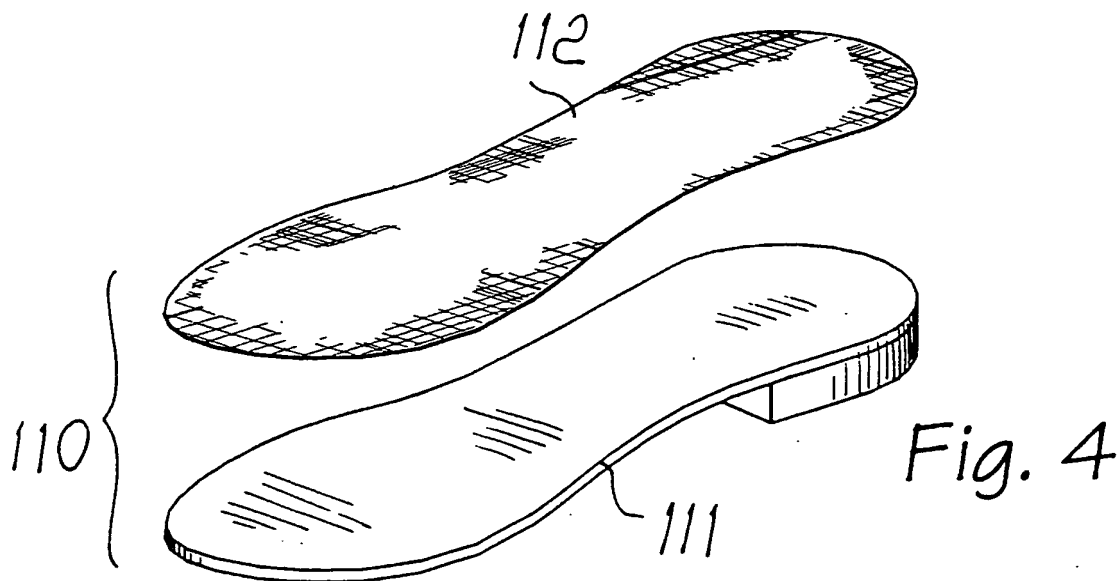
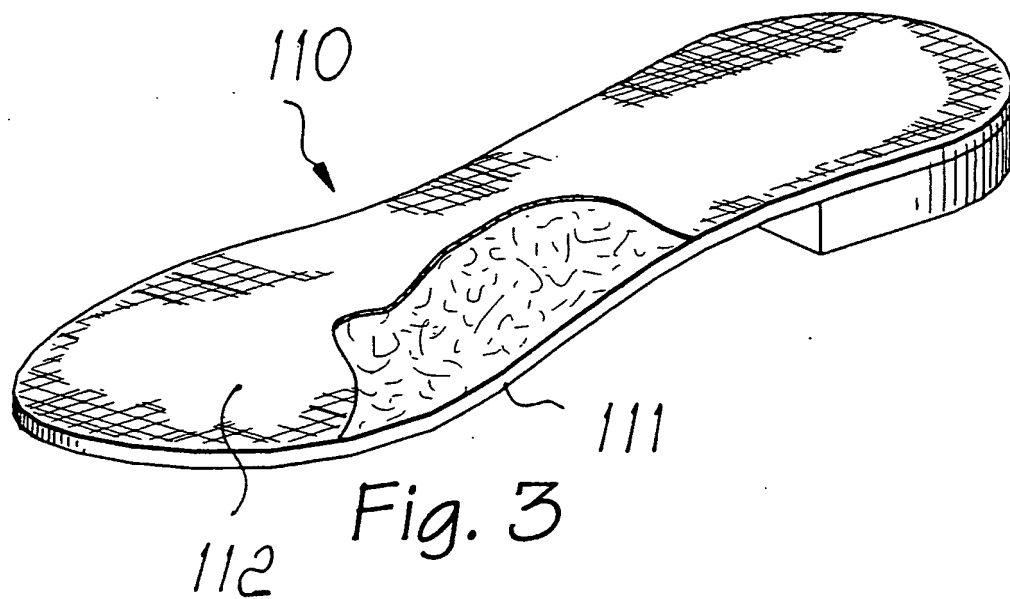
20 -- spreading said hydrophilic polymer on the upper part of the tread,  
-- performing catalysis at high temperature or at a lower temperature by adding reaction promoters,  
-- allowing cooling.

24. The method according to claim 23, characterized in that said  
25 spreading of said hydrophilic prepolymer on the upper part of said tread is provided by way of a brush, a doctor blade, a roller, or by spraying.

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## INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 01/15327

A. CLASSIFICATION OF SUBJECT MATTER  
 IPC 7 A43B7/12 A43B7/02 A43B13/12

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
 IPC 7 A43B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

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Y	cited in the application the whole document	1-3, 12
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

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Date of the actual completion of the international search

18 April 2002

Date of mailing of the international search report

29/04/2002

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## INTERNATIONAL SEARCH REPORT

International Application No  
PCT/JP 01/15327

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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